

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. **(Currently amended)** A circuit to control the capacitance of a variable capacitor in a strictly linear mode ~~through~~ a steady tuning voltage and to achieve a high Q-factor at the same time; comprising:

a set of individual small capacitors;

a set of capacitor switching stages, each stage comprising;

a switching device, allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel;

a circuit to control the switching operation of said switching device in a steady ramp-up/ramp-down manner between the points of being fully switched on and fully switched off, provided to said switching device, comprising;

a translinear amplifiers to produce the ramp-up/ramp-down signal for each of said set of switching devices, where said translinear amplifier is implemented within said circuit to control the switching operation;

a circuit to individually provide the threshold ~~points~~ levels for each of said capacitor switching stages, building a measure for the input and the output reference levels for each of said translinear amplifiers within said capacitor switching stages;

a circuit to provide the output reference level for said translinear amplifiers; ; and

a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to the inputs of all of said capacitor switching stages.

2. **(Currently amended)** The circuit of claim 1 wherein said switching device with steady ~~transition~~ ramp-up/ramp-down phase is a FET transistor.

3. **(Currently amended)** The circuit of claim 2 wherein said switching device with steady ~~transition~~ ramp-up/ramp-down phase is a P-MOSchannel or N-MOS channel junction FET.

4. **(Currently amended)** The circuit of claim 2 wherein said switching device with steady ~~transition~~ ramp-up/ramp-down phase is a CPMOS or NMOS FET.

5. **(Currently amended)** The circuit of claim 1 wherein said circuit to individually provide said threshold ~~points~~levels for each individual capacitor switching stage generates a set of reference values, one value for each capacitor switching stage.

6. **(Previously amended)** The circuit of claim 5 wherein said circuit to generate a set of reference values, one for each of said capacitor switching stages, is implemented as a chain of resistors.

7. **(Original)** The circuit of claim 1 wherein said translinear amplifier has a gain of 1, the typical gain of translinear amplifiers.

8. **(Currently amended)** The circuit of claim 1 wherein said translinear amplifier has a gain differing from 1, which gives one more degree of freedom to optimize the operating parameters by making the steepness of the switching device's gate control voltage versus tuning voltage adjustable through proper gain selection, thus making the like overlapping of capacitor switching operation independent of the selected distance of the switching points of adjacent capacitor stages.

9. **(Previously amended)** The circuit of claim 1 wherein said circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, is a single signal connected to all of said capacitor switching stages.

10. **(Currently amended)** The circuit of claim 1 wherein the circuit to provide the output reference level for ~~the said~~ translinear amplifiers, is a single signal connected to all translinear amplifier reference outputs.

11. **(Original)** The circuit of claim 1 wherein said capacitors are discrete capacitor components.

12. **(Previously amended)** The circuit of claim 1 wherein said capacitors are manufactured on a planar carrier, separate from the circuit carrier.

13. **(Original)** The circuit of claim 1 wherein said capacitors are integrated on a semiconductor substrate, but on a separate substrate than said switching devices and amplifiers.

14. **(Original)** The circuit of claim 1 wherein said capacitors are integrated on a semiconductor substrate and on the same substrate as said switching devices and amplifiers.

15. **(Original)** The circuit of claim 1 wherein said capacitors are manufactured as a Metal-Oxide structure.

16. **(Original)** The circuit of claim 1 wherein said capacitors are manufactured as a junction capacitor.

17. **(Currently amended)** A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a high Q-factor at the same time, by controlling a multiple of switching devices through steady control signals when said switching devices operate within their steady ramp-up/ramp-down area and by sharply cutting off the control signals, when said switching devices is operate outside its-their steady transition-ramp-up/ramp-down area; comprising:

a set of individual small capacitors;

a set of capacitor switching stages, each stage comprising:

a switching device allowing ~~a-said~~ steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel;

a circuit to control the switching operation ~~in a ramp-up/ramp-down manner, provided to of~~ said switching device, ~~as long as said switching device operates in its steady transition area, i.e. within the points of being fully switched on and fully switched off~~ comprising;

a translinear amplifiers to produce the said steady ramp-up/ramp-down signal for said switching device, where said translinear amplifier is implemented within said circuit to control the switching operation;

a circuit to drive said switching device to a fully on status, when said switching device ~~is operates~~ outside said steady transition ramp-up/ramp-down area on the ~~said switching device's~~ lower resistance side, and implemented in combination with said translinear amplifier;

a circuit to drive said switching device to a fully off status, when said switching device is beyond said steady transition ramp-up/ramp-down area on the ~~said switching device's~~ higher resistance side, and implemented in combination with said translinear amplifier;

a circuit to individually provide the threshold ~~points-levels~~ for each of said individual capacitor switching stages, building a measure for the input and the

output reference levels for each of said translinear amplifiers within said capacitor switching stages; and

a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages.

18. **(Currently amended)** The circuit of claim 17 wherein said circuit to drive said switching device to a fully-on status, when said switching device is-operates outside its desired steady transition area on the lower resistance side is provided by additional circuit elements, working as a signal-limiting cutoff function.

19. **(Currently amended)** The circuit of claim 17 wherein said a circuit to drive said switching device to a fully-off status, when said switching device is-operates outside its desired steady transition area on the higher resistance side is provided by additional circuit elements, working as a signal-limiting cutoff function.

20. **(Currently amended)** The circuit of claim 18 wherein said signal-limiting cutoff function to drive said switching device to a fully-on status, when said switching device is-operates outside its desired steady transition ramp-up/ramp-down area on the said switching device's lower resistance side, are-is implemented within the said translinear amplifier circuit.

21. **(Currently amended)** The circuit of claim 19 wherein said signal-limiting cutoff function to drive said switching device to a fully-off status, when said switching device is-operates outside its desired steady transition ramp-up/ramp-down area on the said switching device's higher resistance side, are-is implemented within the said translinear amplifier circuit.

22. **(Original)** The circuit of claim 17 wherein said translinear amplifier has a gain of 1, the typical gain of translinear amplifiers.

23. **(Currently amended)** The circuit of claim 17 wherein said translinear amplifier has a gain differing from 1, which gives one more degree of freedom to optimize operating parameters, like overlapping of capacitor switching operation and signal cut-off at the edges of the said steady transition ramp-up/ramp-down area.

24. **(Previously Cancelled)**

25. (Previously Cancelled)

26. (Currently amended) A circuit to control the capacitance of a variable capacitor in a strictly linear mode through a steady tuning voltage and to achieve a high Q-factor at the same time, by controlling a multiple of capacitor switching devices through steady control signals and to-by compensating the temperature deviation of the said capacitor switching devices; comprising:

a set of individual small capacitors;

a set of capacitor switching stages, each stage comprising:

a switching device allowing a steady transition-ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors to connect a multiple of said capacitors in parallel;

a circuit to control the switching operation of said switching device, including a steady transition-ramp-up/ramp-down phasemanner, comprising;

a translinear amplifier to produce said control signal for said switching device, and implemented within said circuit to control the switching operation;

a circuit to compensate the temperature deviation of said switching device, and implemented within said circuit to control the switching operation;

a circuit to individually provide the threshold points-levels for each of said capacitor switching stages, building a measure for the input and the output reference levels for each of said translinear amplifiers within said capacitor switching stages; and

a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages.

27. (Previously amended) The circuit of claim **26** wherein said circuit to compensate the temperature deviation of said switching device is provided by feeding a modified reference voltage to said translinear amplifier's output reference point, to mirror a temperature correcting signal into the control signal of said switching device.

28. (Previously amended) The circuit of claim **27** wherein said circuit to compensate the temperature deviation of said switching device, uses a device of the same type as said switching device itself, to produce an exact equivalent of said temperature deviation.

29. (Previously Cancelled)

30. **(Currently amended)** The circuit of claim 1 wherein said circuit to individually provide said threshold ~~points~~levels for each of said capacitor switching stages, generates a set of reference values, one value for each capacitor switching stage, in a non-linear relation between said tuning voltage and said threshold ~~points~~levels.

31. **(Currently amended)** The circuit of claim 30 wherein said a circuit to individually provide the threshold ~~points~~levels, for each circuit to control the switching operation, in a non-linear relation between said tuning voltage and said threshold ~~points~~levels, is provided by specifically selecting the steps of a set of reference values in a way, to achieve said desired non-linear relation.

32. **(Previously amended)** The circuit of claim 31 wherein said circuit to generate said set of reference values, one for each of said circuit to control the switching operation, is implemented as a chain of resistors.

33. **(Currently amended)** A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, comprising: a switching device allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors, to connect a multiple of said capacitors in parallel, a circuit to control the switching operation of said switching device in a ramp-up/ramp-down manner between the points of being fully switched on and fully switched off, ~~provided to said switching device, and comprising a translinear amplifier to produce said control signal for said ramp-up/ramp-down switching operation,~~ and a circuit to individually provide the threshold ~~points~~levels for each of said capacitor switching stages, a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

providing said threshold ~~points~~levels for each individual capacitor switching stage;

supplying said signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, by means of a said translinear amplifier, the difference of said tuning voltage and said threshold ~~points~~levels within each capacitor switching stage to produce the linear control signal for a ramp-up/ramp-down switching operation;

fully switching on one of said switching devices in order to completely switch one of said small capacitors in parallel to the already switched on capacitors, one after the other to linearly increase the total capacitance;

fully switching off one of said switching devices in order to completely disconnect one of said small capacitors from the other switched on capacitors, one after the other, to linearly decrease the total capacitance; and
ramping up or ramping down the switching operation of one of said switching devices to partially switch, with increasing/decreasing share, one of said small capacitors in parallel to the already switched on capacitors, one after the other.

34. (Currently amended) The method of claim **33** wherein linearly controlling the switching operation applies to a FET transistor as the switching device with steady ~~transition~~ ramp-up/ramp-down phase.

35. (Currently amended) The method of claim **34** wherein linearly controlling the switching operation applies to a P-MOSchannel or N-MOS channel junction FET as said switching device with steady ~~transition~~ ramp-up/ramp-down phase.

36. (Currently amended) The method of claim **34** wherein linearly controlling the switching operation applies to a P-channel or N-channel CMOS FET as said switching device with steady ~~transition~~ ramp-up/ramp-down phase.

37. (Currently amended) The method of claim **33** wherein individually providing said threshold ~~points~~ levels for each individual capacitor switching stage generates a set of reference values, one value for each capacitor switching stage.

38. (Previously amended) The method of claim **37** wherein generating a set of reference values, one for each of said capacitor switching stages, is performed by a chain of resistors.

39. (Original) The method of claim **33** wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to discrete capacitor components.

40. (Previously amended) The method of claim **33** wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to capacitors manufactured on a planar carrier, separate from the circuit carrier.

41. (Original) The method of claim **33** wherein continually switching on one of said small capacitors in parallel to the already switched on capacitors applies to capacitors integrated on a semiconductor substrate.

42. (Previously amended) The method of claim **33** wherein supplying a tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages uses a single signal connected to all amplifier inputs.

43. (Currently amended) A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time by sharply cutting off the control signal, when ~~said a~~ switching device ~~is operates~~ outside its steady ~~transition~~ ramp-up/ramp-down area; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, each comprising: a switching device allowing a steady ramp-up/ramp-down phase between the points of being fully switched on and fully switched off, and where said switching device is connected in series with one of said capacitors in parallel, a circuit to control the switching operation of said switching device in a ramp-up/ramp-down manner between the points of being fully switched on and fully switched off, ~~provided to said switching device,~~ and comprising, in addition to a translinear amplifier, a circuit to overdrive said switching device to a fully-on status, when said switching device ~~is operates~~ outside its steady ~~transition~~ ramp-up/ramp-down area on the ~~said switching device's~~ lower resistance side, as well as a circuit to overdrive said switching device to a fully-off status, when said switching device is beyond its steady ~~transition~~ ramp-up/ramp-down area on the ~~said switching device's~~ higher resistance side, ~~a translinear amplifier,~~ and a circuit to individually provide the threshold ~~points~~ levels for each of said capacitor switching stages, a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

providing said threshold ~~points~~ levels for each individual capacitor switching stages;

supplying said signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, with ~~a said~~ translinear amplifier, the difference of said tuning voltage and said threshold ~~points~~ levels of each amplifier stage, to produce the linear control signal for a ramp-up/ramp-down switching operation;

steadily ramp-up/ramp-down switching on or off said switching device in order to partially switch, with increasing/decreasing share, said small capacitor in parallel to the already switched on capacitors, one after the other, to linearly increase or decrease the total capacitance;

linearly controlling the switching function for each of said switching device with steady ramp-up/ramp-down phase, when said switching device is in its steady ~~transition~~ ramp-up/ramp-down area;

driving said switching device to a fully on status, when said switching device is operates outside its steady transition ramp-up/ramp-down area on the said switching device's lower resistance side; and

driving said switching device to a fully off status, when said switching device is beyond its steady transition ramp-up/ramp-down area on the said switching device's higher resistance side.

44. (Currently amended) The method of claim **43** wherein driving said switching device to a fully-on status, when said switching device is operates outside its desired steady transition ramp-up/ramp-down area on the said switching device's lower resistance side uses additional circuit elements, working as a signal-limiting cutoff function.

45. (Currently amended) The method of claim **43** wherein driving said switching device to a fully-off status, when said switching device is operates outside its steady transition ramp-up/ramp-down area on the said switching device's higher resistance side uses additional circuit elements, working as a signal-limiting cutoff function.

46. (Currently amended) The method of claim **44** wherein said signal-limiting cutoff operation to drive said switching device to a fully-on status, when said switching device is operates outside its steady transition ramp-up/ramp-down area on the lower resistance is implemented within the said translinear amplifier.

47. (Currently amended) A method to control the capacitance of a variable capacitor in a strictly linear mode through a tuning voltage and to achieve a high Q-factor at the same time and to compensate the temperature deviation of the capacitor switching device; comprising:

providing a set of individual small capacitors, a set of capacitor switching stages, each comprising: a switching device with steady transition ramp-up/ramp-down phase to continually switch on said capacitors in parallel, a circuit to control the switching operation of said switching device and comprising, a translinear amplifier to produce said linear control for said switching function, - a circuit to compensate the temperature deviation of said switching device, and a circuit to individually provide the threshold points-levels for each individual capacitor switching stage, a circuit to provide a signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

providing said threshold points-levels for each individual capacitor switching stage;

supplying said signal, dependent on the tuning voltage, dedicated for the voltage controlled capacitance change, to all of said capacitor switching stages;

amplifying, with a said translinear amplifier, the difference of said tuning voltage and said threshold ~~points~~ levels within each capacitor switching stage, to produce the linear control signal for a ramp-up/ramp-down switching operation;
continually switching on one of said switching devices with steady ~~transition~~ ramp-up/ramp-down phase in order to switch one of said small capacitors in parallel to the already switched on capacitors, one after the other;
linearly controlling the switching function for each of said switching devices with steady ~~transition~~ ramp-up/ramp-down phase; and
compensating the temperature deviation of said switching device.

48. **(Original)** The method of claim 47 wherein compensating the temperature deviation of said switching device is provided by feeding a modified reference voltage to said translinear amplifier's output reference point, to mirror a temperature correcting signal into the control signal of said switching device.

49. **(Original)** The method of claim 48 compensating the temperature deviation of said switching device, uses a device of the same type as said switching device itself, to produce an exact equivalent of said temperature deviation.

50. **(Previously Cancelled)**

51. **(Currently amended)** The method of claim 33 wherein individually providing said threshold ~~points~~ levels for each individual capacitor switching stage generates a set of reference values, one value for each capacitor switching stage in a non-linear relation between said tuning voltage and said threshold ~~points~~ levels.

52. **(Currently amended)** The method of claim 51 wherein providing a non-linear relation between said tuning voltage and said threshold ~~points~~ levels is provided by specifically selecting the steps of said set of reference values in a way, to achieve said desired non-linear relation